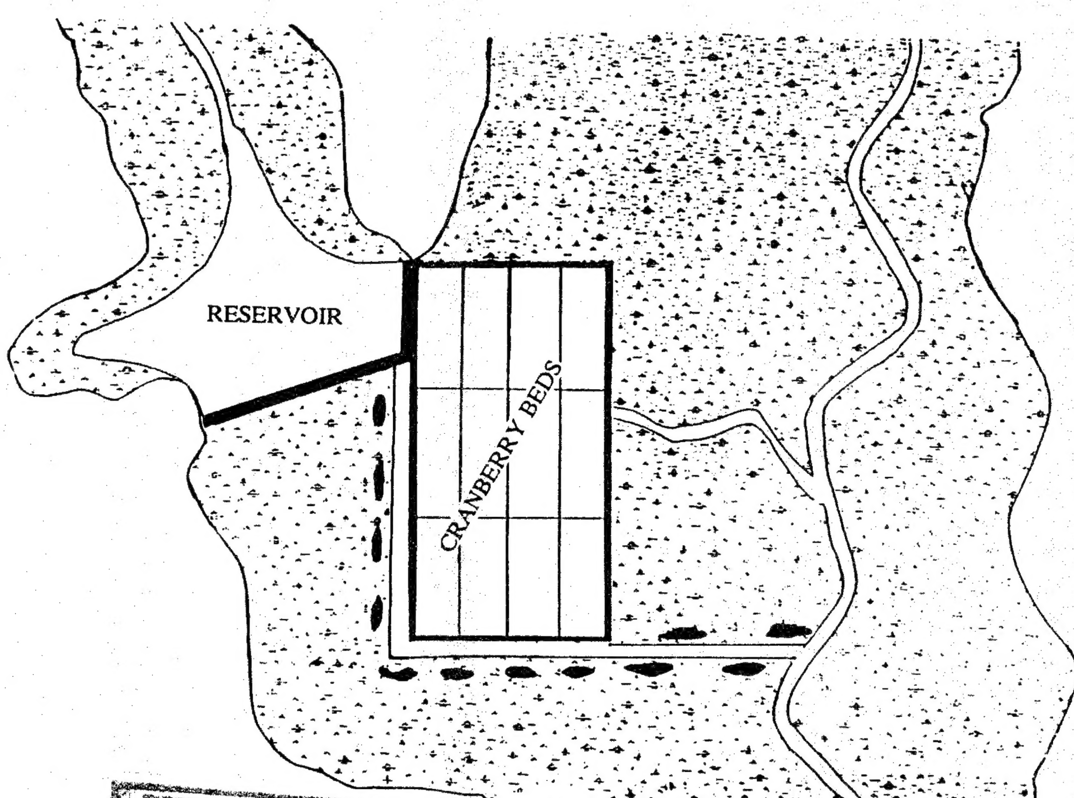
US Army Corps
of Engineers
St. Paul District

ST. PAUL DISTRICT ANALYSIS

REGARDING SECTION 404 REVIEW

OF

COMMERCIAL CRANBERRY OPERATIONS



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The purpose of this report is to update and expand the policy of the St. Paul District of the Corps of Engineers dated October 7, 1981. The previous policy addressed only the applicability of Section 404(f) exemptions to cranberry projects. It is clear that a need exists to address additional issues related to review of permit applications, pursuant to Section 404 of the Clean Water Act, for cranberry operations. Inconsistencies in review of permit applications have resulted because of the lack of guidelines addressing all aspects of cranberry projects. Adoption of the guidelines described in this analysis would promote consistent approach in evaluating all future applications for cranberry projects.

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SUMMARY

Recognizing that its 1981 policy regarding regulation of commercial cranberry operations under Section 404 was outdated and inadequate, the St. Paul District of the Corps of Engineers (Corps) released a draft report in 1991 that expanded and updated the former policy. The impetus for this action primarily involved two factors: (1) a substantial increase in the number and magnitude of permit applications for cranberry projects in Wisconsin; and (2) a desire to achieve a consistent approach in evaluating permit applications for cranberry projects. The draft report was circulated to all known interested parties to solicit comments. This included the cranberry industry, regulatory agencies, environmental groups and Corps districts involved with regulating commercial cranberry projects in other parts of the country. Additionally, a public meeting was held in Madison, Wisconsin, on June 20, 1991. A wealth of information was generated for use in preparing this final report.

Comments on the draft resulted in two major changes in this final report. One is the determination that commercial cranberry operations are "water dependent" within the meaning of the 404(b)(1) guidelines. The other was the determination that cranberry beds are wetlands -- they are best described as "cropped wetlands." Positions stated in the draft report concerning water quality impacts, water budget, ecological impacts, compensatory mitigation, and other issues remain unchanged in this final report.

The draft report prompted a number of actions as described below:

1. The issue of water dependency of commercial cranberry operations was raised to the national headquarters of the Corps and U.S. Environmental Protection Agency (EPA). This was necessary to achieve the goal of adoption of a consistent approach by all Corps districts nationwide that deal with cranberry operations. After consultation with EPA, the national headquarters of the Corps issued a regulatory guidance letter in June 1992 that addressed the water dependency of cranberry operations (Appendix C).

2. The recommendation contained in the draft concerning the need for a long-term water quality study was pursued. Considerable effort was expended by the cranberry industry and regulatory agencies to design and implement a water quality study; unfortunately, lack of funding and disagreement over inclusion/exclusion of pesticide testing resulted in an impasse.

3. The water budget data sheet contained in the draft has been implemented by the St. Paul District as a standard requirement of permit applications for cranberry projects. Refer to Appendix B.

4. Compensatory mitigation is being required to offset the unavoidable adverse impacts of commercial cranberry projects as recommended in the draft. Refer to pages 30-31.

5. Questions regarding 404(f) exemptions for sandpits and sanding activities associated with cranberry operations prompted the national headquarters of the Corps and EPA to issue a memorandum dated June 12, 1995, that addressed this issue. The memorandum is discussed on pages 33-34 of this report.

I. INTRODUCTION

A. PURPOSE AND NEED

The purpose of this report is to update and expand the policy of the St. Paul District of the Corps of Engineers (Corps) dated October 7, 1981. The previous policy addressed only the applicability of Section 404(f) exemptions to cranberry projects. It is clear that a need exists to address additional issues related to review of permit applications, pursuant to Section 404 of the Clean Water Act, for cranberry operations. Inconsistencies in review of permit applications have resulted because of the lack of guidelines addressing all aspects of cranberry projects. Adoption of the guidelines described in this analysis would promote a consistent approach in evaluating all future applications for cranberry projects.

B. KEY ISSUES

This report discusses the following topics that represent key issues involved in evaluating permit applications for cranberry projects:

1. "Water dependency" of cranberries;
2. Water quality impacts of cranberry projects;
3. Water budget for cranberry projects;
4. Ecological impacts of cranberry projects;
5. Compensatory mitigation for cranberry projects;
6. 404(f) exemptions for cranberry projects; and
7. Policy implications of U.S. v. Huebner.

The abbreviation (per. comm.) will be used for citing the source of information obtained by personal communication. All personal communications were between the person listed and Steve Eggers (Senior Ecologist, Regulatory Branch, St. Paul District of the Corps) unless noted otherwise.

C. BACKGROUND

A common problem encountered throughout formulation of this analysis was the lack of information on the environmental impacts of modern cranberry operations. An extensive literature search of published information was conducted and numerous sources were consulted regarding unpublished or other research data. Little information is available on some of the specific issues addressed by this analysis. The cranberry industry is actively involved in research programs including environmental impacts of cranberry operations. The St. Paul District of the Corps contacted the Cranberry Institute in East

Wareham, Massachusetts, and requested copies of research as it becomes available. We have since received several recently completed studies courtesy of the cranberry industry.

Another problem was the variables from one cranberry operation to another, and from one region to another. As a result, it is not feasible to develop a comprehensive set of standards that would be applicable to all of the individual cranberry growers and their operations. Instead, the intent of this analysis is to provide general guidelines for review of Section 404 permit applications for cranberry projects. It will be necessary to augment these general guidelines with case-by-case analyses tailored to the specifics of each permit application.

D. RECENT STATUS AND TRENDS OF CRANBERRY EXPANSIONS IN THE U.S.

The context of this report is regulation of cranberry activities under U.S. statutes; specifically, Section 404 of the Clean Water Act. Therefore, the discussion on status and trends does not include Canadian cranberry operations.

The four major cranberry producing areas in the U.S. are Wisconsin, Massachusetts, New Jersey and the Pacific Northwest (Washington and Oregon). Cranberry production in all four date back to the mid- to late-1800s. Over 31,000 acres of cranberry beds were harvested in 1993 as shown by Table 1. The acreage of beds currently in production

TABLE 1
CRANBERRY PRODUCTION IN THE U.S.

STATE	1993 Harvested Acres	1994 Harvested Acres (est)	1993 Production *bbls	1994 Production *bbls (est)	**1994 Tot Planted Acres (est)
Wisconsin	11,333	12,008	1,352,898	1,630,000	14,091
Massachusetts	13,140	13,402	1,880,904	1,925,000	13,964
New Jersey	3,493	3,584	387,644	290,000	3,893
Washington	1,506	1,552	135,964	160,000	1,657
Oregon	1,541	1,633	151,675	252,000	1,927
Total U.S.	31,013	32,179	3,909,085	4,457,000	35,532

Note: All figures from Cranberry Marketing Committee, USDA
* One barrel (bbls) equals 100 pounds
** Estimates of acreage and 1994 crop from the Cranberry Marketing Committee, USDA

in Massachusetts and New Jersey has declined since the 1950s while the acreage of beds in Wisconsin has been increasing. In the 1940s approximately 15,000 acres of beds were cultivated in Massachusetts compared to 13,140 in 1993, while the decline in New Jersey has been more dramatic -- 13,000 acres in the 1930s to 3,493 acres in 1993 (IEP, Inc. 1991a and Cranberry Marketing Committee, USDA).

Information was collected to determine the status and trends of cranberry production in each of the four major cranberry producing regions. In recent years, very few Section 404 permit actions have occurred in three of the four regions: Massachusetts, New Jersey and the Pacific Northwest. The situation in Wisconsin is very different as illustrated by the numerous Section 404 permit actions dealing with expansions of existing cranberry operations, as well as construction of new operations. In the late 1980s more acres of Wisconsin wetlands were being impacted by cranberry projects than by any other activity regulated by Section 404. In calendar years 1988 and 1989, the St. Paul District received 42 and 33 permit applications, respectively, for cranberry projects. Collectively, those projects would affect approximately 1,757 acres and 2,309 acres, respectively, of wetlands. Single applications have been received to construct between a few acres to as many as 200 acres of new cranberry beds in wetlands. In some cases it was proposed to convert uplands to cranberry beds, but the majority proposed to build the beds in wetlands. Additionally, applications have typically included proposals for construction of new reservoirs and ditches. These also can result in adverse impacts to wetlands.

Recent trends in Wisconsin show a much lower rate of wetland conversion to cranberry projects than that experienced during the late 1980s. It should be noted that the Wisconsin Cranberry Law, enacted in 1867, exempts growers from permit requirements for damming, ditching, and other activities that would otherwise be regulated under Wisconsin statutes. However, in 1991 the State of Wisconsin adopted wetland water quality standards under Chapter NR 103 of the Wisconsin Administrative Code. These standards are applied in making Section 401 water quality certifications for Section 404 permit applications. Cranberry projects in Wisconsin must conform to these standards as does any project requiring a Section 404 permit.

In general, projects that destroy or alter wetlands are coming under increasing scrutiny and cranberry operations are no exception. Agencies, organizations and individuals have expressed concern over the number and magnitude of cranberry projects in Wisconsin.

Cranberry growers in Wisconsin are acutely aware of this increased degree of scrutiny. Growers are generally well informed of the regulations. Additionally, growers are continuing to develop and implement new techniques and technologies that are not only more cost-effective, but also have greater environmental safeguards (e.g., integrated pest management programs). Growers see themselves as stewards of wetlands and are proud of the wildlife benefits associated with their wetlands. Furthermore, growers believe their operations do not have any appreciable adverse water quality impacts.

In summary, the situation in Wisconsin is unique with regard to the number and magnitude of cranberry projects. Corps districts/divisions covering other regions have typically been reviewing only a few individual permit applications each year for cranberry projects, most of which involve less than 10 acres of wetland impacts. The large scale expansions in Wisconsin appear to be due to the following:

1. Availability of undeveloped land suitable for conversion to cranberry culture;

2. Availability of abundant water supplies;

3. Expanding markets and increasing profitability that make cranberries a growing industry;

4. The Wisconsin Cranberry Law, enacted in 1867, which exempts growers from having to obtain permits for damming, ditching, and other activities that would otherwise be regulated under Wisconsin statutes; however, since 1991 cranberry projects must conform to NR 103 wetland water quality standards.

5. Favorable permit decisions by the St. Paul District of the Corps, which has generally determined that cranberry projects are not contrary to the public interest. This trend has continued although cranberry projects have been under increased scrutiny and efforts to avoid, minimize and compensate for wetland impacts.

II. PUBLIC INVOLVEMENT

Public involvement was solicited via a comment period following release of the draft report as well as a public meeting held in Madison, Wisconsin, on June 20, 1991. A wealth of information was generated. This information was evaluated and used to formulate the final conclusions of this report.

A. COMMENTS ON THE DRAFT REPORT

Basically, the majority of comments on the draft report can be placed into two groups: (1) those from the resource agencies, Native American tribes and environmental groups; and (2) those from the cranberry industry (including university extension services). It should be noted that other Corps of Engineers districts responded as well.

Resource agencies who provided comments included the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Department of the Interior -- Bureau of Indian Affairs, Wisconsin Department of Natural Resources, Michigan Department of Natural Resources, New Jersey Department of Environmental Protection and Oregon Division of State Lands. Other groups who provided comments include the Great Lakes Indian Fish and Wildlife Commission and the Wisconsin Wetlands Association.

Members of the second group included The Cranberry Institute, Wisconsin State Cranberry Growers Association, Oregon Cranberry Farmers' Alliance, Cape Cod Cranberry Growers' Association, American Cranberry Growers' Association, University of Massachusetts - Cranberry Experiment Station, University of Wisconsin - Madison and University of Wisconsin Extension faculty, as well as numerous individual growers from all cranberry producing regions of the country.

In general, the resource agency group concurred with the positions taken in the draft that: (1) cranberries are not a water dependent activity under the Section 404 (b)(1) guidelines; and (2) a comprehensive water quality study is necessary to more fully ascertain water quality impacts of cranberry operations. One agency specifically cited the lack of information on the toxicity and long-term effects of the pesticides used by cranberry growers. Agencies stated concurrence with the discussion in the draft concerning the adverse impacts of converting natural wetlands to cranberry beds and that compensatory mitigation should be required to offset these adverse impacts. Contrary to the discussion in the draft report, several resource agencies stated that they believed cranberry beds -- although subject to drainage, filling and water level manipulations -- would still meet wetland criteria under State and Federal delineation methodologies.

Summarizing the response of the cranberry industry group results in the following key points. First and foremost, comments and supporting documentation were provided to demonstrate that cranberry beds are water dependent within the meaning of the Section 404 (b)(1) guidelines. Comments on the environmental conditions necessary for successful cranberry cultivation were provided along with descriptions of the problems associated with cranberry beds constructed in uplands. While it was acknowledged that the cranberry beds themselves may not provide the functions/values of natural wetlands, it was suggested that the cranberry operation as a whole be considered when evaluating the ecological consequences of converting natural wetlands to cranberry operations. Only 10 percent of cranberry operations are typically devoted to beds -- the remainder is usually composed of reservoirs, natural wetlands, and uplands including forested areas. From an overall perspective, cranberry operations can provide a diversity of habitats and result in set-aside of areas as open space/wildlife habitat.

The following paragraphs discuss in more detail specific comments of representative members of each group.

The U.S. Environmental Protection Agency (EPA) provided a consolidated response from its regional offices located in cranberry producing areas of the country. Included was region-specific information on key issues. Concurrence with the discussion in the draft of the ecological impacts of converting natural wetlands to cranberry beds was stated. EPA commented that the best description of cranberry beds is "farmed wetlands." While this means the beds meet the technical definition of wetlands, EPA stated that conversion of natural wetlands to cranberry beds results in a considerable loss of wetland functions and values. To offset adverse impacts associated with activities such as filling wetlands for dikes, compensatory mitigation with a minimum ratio of 1.5 to 1.0 was recommended. However, a ratio of 1.0 to 1.0 was recommended for areas planted to cranberry vines because these areas still retain some wetland characteristics albeit greatly reduced. Additionally, EPA recommended that the compensation be in-kind to the extent practicable. EPA recommended that compensatory mitigation credit not be given to beds constructed in uplands. Comments on other key issues were considered and incorporated into this final report.

The U.S. Fish and Wildlife Service (FWS) provided specific comments on a number of issues. *The American Cranberry* by Eck (1990) was cited concerning environmental conditions necessary for cranberry culture. Additionally, possible adverse impacts of pesticides were given, "...both the chlorinated hydrocarbon insecticides and herbicides appear to be rather persistent in cranberry soils..." Finally, FWS noted the need to adhere to the mitigation sequence of avoid and minimize, to be followed with compensatory mitigation to offset unavoidable adverse impacts.

Wisconsin growers stated that the only situation where uplands have been successfully converted to cranberry beds is where wetland conditions were simulated by first excavating a site, followed by hauling in peat and providing for a water supply. In essence, it is necessary to create a wetland for successful cranberry culture. A number of growers stated that upland beds have serious problems including the fact that they tend to be more weedy, which leads to a loss of production and greater use of herbicides. Additionally, they believe costs are higher for upland beds because of: (1) increased excavation costs; (2) need to pump water to a higher elevation; and (3) greater quantities of water required to keep the beds at the appropriate moisture level. It is desirable to have a peat layer underneath the sand for water retention instead of a soil profile composed solely of sand as in some upland situations. Furthermore, there may be greater potential for groundwater contamination due to a more rapid rate of infiltration when beds are constructed in sandy soils. It was contended that cranberries are clearly water dependent because the beds are flooded for 3 to 4 months of the year (ice mulch) and for several weeks each fall (harvest) and spring (due to spring thaw). Beds are also flooded in the spring and autumn for frost protection (when temperatures fall below 15 to 17 degrees F. sprinklers are no longer effective and the vines need to be flooded from one day to several weeks at a time).

Information from the Cape Cod Cranberry Growers' Association stated that successful upland beds are very site-specific. Many have been constructed in former sand and gravel pit operations where converting the excavated sand/gravel mining area to cranberry beds was a good way to reclaim the site using the mining profits. Had the sole purpose been to create cranberry beds at these sites, it may have been cost prohibitive to accomplish all the necessary earthmoving. Finally, it was noted that because the Corps has seen successful upland beds in some operations a heavy burden has been placed on each cranberry operator to prove why a proposed cranberry project cannot be built on uplands.

B. PUBLIC MEETING

As was the case with written comments on the draft report, the most debated issue at the public meeting held June 20, 1991, was that of the "water dependency" of commercial cranberry operations. The office of the Wisconsin Public Intervenor, environmental groups, and resource agencies such as the Wisconsin Department of Natural Resources, U.S. Fish and Wildlife Service and U.S. Environmental Protection Agency, contended that cranberry operations are not water dependent. Their key argument was that cranberry beds do not require proximity to or location in wetlands to serve their basic purpose. They contend that while it may be easier to establish cranberry beds in wetlands, the fact remains that cranberry beds can be located in uplands. Representatives of the cranberry industry countered that uplands have to be converted to wetland conditions in order for them to be used for cranberry culture. Furthermore, the productivity (barrels/acre) and overall success of cranberry beds constructed in uplands is still a question among growers. The essential requirement for locating cranberry beds in proximity to a water supply was also stated. EPA reiterated their position that regardless

of whether uplands have to be converted to wetland conditions to support cranberry beds, the fact remains that cranberry beds do not need to be located in existing, natural wetlands. Costs may be higher to construct cranberry beds in uplands, but that does not necessarily preclude use of uplands as a practicable alternative. A comment made at the close of the meeting was that the water dependency issue was more of an interpretation of the regulations rather than a scientific question. Since the subject regulations were issued by EPA, it was suggested that the Corps final position on this issue go through EPA for that agency's interpretation.[1]

[1]Subsequently, the national headquarters of the Corps consulted EPA headquarters concerning the development of a Regulatory Guidance Letter on the water dependency of cranberry operations. This RGL was issued in June 1992 (Appendix C). Also, see the discussion on pages 12 and 13 of this report.

III. WATER DEPENDENCY OF COMMERCIAL CRANBERRY PROJECTS

A. ENVIRONMENTAL CONDITIONS NECESSARY FOR COMMERCIAL CRANBERRY CULTURE

The cranberry vines used commercially are varieties of a native species, *Vaccinium macrocarpon* Ait. (Roper and Planer 1989, Eck 1990). Its primary native habitat is acid bogs where it is typically found growing on *Sphagnum* mats and hummocks. It can also be found in non-acid habitats including shallow, fresh water marshes and wet meadows (IEP, Inc. 1991a). This species is listed as an obligate hydrophyte (Reed 1988) which indicates that it can tolerate anaerobic conditions.

Originally, cranberry culture consisted of simply harvesting the berries from native stands of cranberries. This led to digging ditches around the native stands as a first step in establishing beds, which gradually evolved into more intense management leading to the construction of beds planted as a monoculture. As part of this evolution, about 130 varieties of cranberries have been developed from the native strain as well as seven named hybrids. Only a select few of these, like the Searles and Ben Lear varieties, have become commercially important. Demoranville (1987a) provides a history of this process. All Wisconsin growers use the commercial varieties although a few growers still harvest some old beds with the "wild" or native strain (per. comm. with Dr. Donald Boone, Professor Emeritus, University of Wisconsin). For additional information, refer to Paul Eck's *The American Cranberry* (1990), which provides a comprehensive history of cranberry cultivation in the U.S. as well as detailed information on growing conditions, nutrition, diseases, insects and harvesting.

The optimum substrate for cranberry beds is acidic, sandy soils (pH of 4.0 to 5.5) (Roper and Planer 1989), although some growers prefer to plant the vines directly into acidic peat soils (Eck 1990). A typical construction method used by Wisconsin growers for creating beds in wetlands is scalping of the upper one to two feet of soil followed by placing an 4-to 6-inch layer of sand. More would be used to fill low spots to obtain a level bed. Periodic sand "lifts" of about one-half inch to one-inch in thickness are placed on the beds to stimulate growth of the vines (Wisconsin State Cranberry Growers Assocation 1992).

During the growing season, the optimum is to keep the water table between 9 and 12 inches below the surface elevation of the beds (Eck 1990). It is not desirable to keep the

root zone saturated during the growing season (Eck 1990). Demoranville (1987b), in a discussion of the beneficial results of resanding beds, states that cranberry roots need to be aerated and a coarse sand provides for both surface drainage and aeration the root zone. Poorly-drained beds can have problems with root rot (Mahr et al. 1990). Several species of the soil-inhabiting fungus *Phytophthora* may be responsible for the poor growth and death of cranberry vines in Wisconsin. In Massachusetts, root rot due to *Phytophthora cinnamomi* has caused serious problems. Mahr et al. (1990) recommends that measures such as avoiding over-irrigation, improving drainage by installing drain tile, and deepening side ditches be done to minimize root rot problems.

In Wisconsin it has been our observation that beds constructed in uplands are often in or bordering the transition zone between wetlands and uplands. These uplands possess the least elevation difference compared to wetlands and, therefore, require only minor increases in depth to water table and the amount of earthmoving necessary.

Eck (1990) states that commercial cranberry production on upland soils is possible provided a good water supply is available and the soils are not excessively drained. He cites the Oregon example where sandy, elevated marine terraces are used for cranberry production.

Wisconsin growers stated that they prefer to have a peat layer underneath the sand because of the water retention capacity of peat; they contend that beds constructed in pure sand may tend to be more excessively drained and require additional monitoring to maintain the proper moisture regime. However, Dr. Donald Boone, Professor Emeritus, University of Wisconsin, stated (per. comm.) that it can be easier to control moisture levels in beds constructed in uplands compared to beds with underlying peat because the latter can retain too much moisture and make it difficult to determine how much moisture is retained by the peat at any given time. Similarly, Dr. Boone stated that it can be easier to control fertilizer requirements in beds constructed in uplands as compared to those with underlying peat. Under certain temperature and moisture conditions the underlying peat can undergo decomposition resulting in the release of nitrogen. Release of high levels of nitrogen can result in excessive vine growth and poor fruit production (Eck 1990).

It is interesting to note that Tiner and Zinni (1988), who studied wetland losses in southeastern Massachusetts between 1977 and 1986, found that less than 7 percent of the 695 acres of cranberry beds constructed in uplands were constructed in sand/gravel pits. The majority, 569 acres or 82 percent, were constructed in upland forested areas. This indicates that utilization of uplands for cranberry beds is not limited to conversions of sand and gravel pit operations.

There are both similarities and regional differences between cranberry operations in the Pacific Northwest and those of Wisconsin. In both regions, cranberry beds are located on acidic, sandy soils with a water table maintained between 6 and 12 inches below the

surface of the beds. However, Oregon cranberry beds are located in elevated marine terraces and receive between two to six times the annual rainfall as compared to Wisconsin.

B. DEFINITION OF "WATER DEPENDENCY" IN THE CONTEXT OF THE 404(B)(1) GUIDELINES

In the guidelines used by the Corps to conduct permit evaluations, a "water dependent" activity is defined as one that needs to be located in or near a special aquatic site in order to fulfill its basic purpose (40 CFR 230.10). Six special aquatic sites are listed (40 CFR 230.40 to 230.45): (1) wetlands; (2) riffle and pool complexes; (3) vegetated shallows; (4) mud flats; (5) sanctuaries and refuges; and (6) coral reefs. The only one that is typically pertinent to applications for cranberry projects is wetlands. Note that special aquatic sites <u>**do not**</u> include rivers and lakes with the exception of when they conform to one of the specific types listed in (1) through (5). This narrow application of "water dependent" has led to confusion -- "special aquatic site dependent" or, in the case of cranberries, "wetland dependent," would be more accurate.

The significance of whether a project is considered water dependent or non-water dependent involves compliance with the 404(b)(1) guidelines (40 CFR 230). The guidelines state that no discharge of dredged or fill material into special aquatic sites will be permitted if there is a practicable alternative to the discharge that would have less adverse impact on the aquatic ecosystem. Consistent with this restriction are two rebuttable presumptions concerning all discharges into special aquatic sites:

-- A presumption that alternatives to discharges into special aquatic sites are available unless clearly demonstrated otherwise; and

-- A presumption that alternatives involving discharges outside of special aquatic sites have less adverse impact on the aquatic ecosystem than do discharges into special aquatic sites unless clearly demonstrated otherwise.

The above presumptions do not apply to projects determined to be "water dependent." However, it is important to point out that all discharges, whether or not "water dependent," must represent the least environmentally damaging practicable alternative in order to comply with the 404(b)(1) guidelines.

C. CRANBERRIES AS "WETLAND CROP SPECIES" IN CORPS REGULATIONS

Commercial cranberry beds have traditionally been constructed in wetlands, or uplands converted to wetland conditions, and the cranberry plant is considered a wetland species (hydrophyte). These facts led to the reference to cranberries as a "wetland crop species" in Corps regulations (33 CFR 323.4).

D. ST. PAUL DISTRICT ANALYSIS

The preceding discussions under III.A. Environmental Conditions Necessary For Commercial Cranberry Culture, illustrate that wetland conditions are necessary for cranberry beds. Cranberry beds have been constructed in uplands, but in essence those uplands have to be converted to a managed wetland condition for successful cranberry culture.

Following release of the draft of this report, the issue of the water dependency of commercial cranberry operations was raised to the national headquarters of the Corps of Engineers and the U.S. Environmental Protection Agency. Subsequently, the Corps and EPA issued a joint regulatory guidance letter (RGL) on June 26, 1992 (see Appendix C). This guidance states that it is essential for cranberry beds to be located in or near wetlands to serve their basic purpose -- thus, commercial cranberry beds are a "water dependent" activity within the meaning of the 404(b)(1) guidelines. This determination is compatible with the reference in Corps regulations to cranberries as a "wetland crop species." Consequently, the two rebuttable presumptions listed by III.B. do not apply to discharges of dredged or fill material directly associated with cranberry bed construction (e.g., dikes). However, consistent with the 404(b)(1) guidelines, the proposed discharge must still represent the least environmentally damaging practicable alternative (see 40 CFR 230.10(a)). For commercial cranberry culture, practicable alternatives may include upland sites with proper characteristics for creating the conditions necessary for cranberry culture.

Concerning the practicability of upland sites for cranberry beds, the RGL states, "Factors that must be considered in making a determination of whether or not upland alternatives are practicable include soil pH, topography, soil permeability, depth to bedrock, depth to seasonal high water table, adjacent land uses, water supply, and, for expansion of existing cranberry operations, proximity to existing cranberry farms." Further research documenting a comparison of upland versus wetland beds utilizing a number of different varieties would be extremely useful. Parameters should include production (barrels/acre), quantity of water used, weed problems, herbicide use and cost to construct.

In contrast to bed construction, the RGL states that the following activities often associated with cranberry operations are not water dependent: construction of roads, ditches and reservoirs as well as secondary support facilities for shipping, storing or parking. The rebuttable presumptions stated by III.B. above do apply to discharges of dredged or fill material associated with these activities. It is recognized that construction of these facilities needs to be proximate to the cranberry beds. This is to be taken into consideration in determining the least environmentally damaging practicable alternative. "Practicable" means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purpose.

To summarize, full consideration is given to the cost, feasibility and ecological impacts of the upland alternative recognizing that upland construction may not be feasible and/or less environmentally damaging depending on the specifics of each site. For example, it is anticipated that there could be cases where no uplands would be located within the project area, or located at such a distance from a water source as to be impractical for locating cranberry beds. These are items to be documented by the applicant.

One of the primary reasons for initiating this report was to correct the inconsistencies by the Corps and others in determining whether cranberries are or are not "water dependent." The aforementioned RGL will serve to ensure a consistent approach on this issue by all Corps districts and EPA regions.

IV. WATER QUALITY IMPACTS OF COMMERCIAL CRANBERRY PROJECTS

A. LITERATURE SEARCH

A literature search was conducted by the Corps of Engineers Waterways Experiment Station (WES) to obtain all published data on water quality impacts of cranberry operations. Most of the studies do not address the specific issues considered in this analysis, and many others are not useful because the sample size was too small, or the sampling techniques were not well documented, or the studies were out-dated because cranberry practices have changed since the data was gathered. The following two paragraphs are excerpted from the memorandum dated November 14, 1989, from WES to the St. Paul District of the Corps.

"No definitive conclusions can be drawn from the documents reviewed with respect to the impact of cranberry operations on water quality. In some cases the reports of high phosphorus and pesticide concentrations (above Environmental Protection Agency guidelines) in waters discharged from cranberry fields suggest that there is reason for environmental concern. However, the information the St. Paul District needs in order to make informed 404 permit decisions on the impacts of cranberry cultivation on water quality does not appear to be available in the current literature."

"A few of the documents reviewed contain information which should be considered in greater detail if further studies are undertaken. However, most of the documents will not be useful in defining the relation between cranberry bogs and water quality. Nearly one-fourth of the documents were non-technical in nature and written for the general public. Of the forty-one articles provided, only five were peer-reviewed articles appearing in recognized scientific journals. Most of the water chemistry data was based on single or occasional grab samples. Few of the studies attempted mass-balance calculations which are necessary to estimate annual yields of chemical constituents and assess seasonal variability. Many of the documents lack complete documentation of the methods used and their sampling protocol. Some of the studies performed during the 1960s and 1970s addressed management practices and cultivation techniques and pesticide types that are no longer commonly used. There is nearly a complete lack of valid groundwater data and few good studies on the impacts of cranberry pesticides."

B. RECENT WATER QUALITY STUDIES

Two recent water quality studies involving commercial cranberry operations have been completed. Both have the limitations of being short-term and small in scope -- one involved a single lake and the other involved three streams. Therefore, it would not be prudent to make across-the-board conclusions about the water quality impacts of cranberry operations based solely on these studies. Nonetheless, the studies suggest that commercial cranberry operations may have adverse water quality impacts, which leads to the conclusion that further studies are warranted.

Biomonitoring of two commercial cranberry operations in Jackson County, Wisconsin, was conducted by the Wisconsin Department of Natural Resources (WDNR) in 1992 (Schreiber 1993). This included sampling in streams both upstream and downstream of cranberry operations with the upstream samples serving as the control. A limitation of the study was that the results are based on short-term sampling -- samples were collected on three occasions during one year. An important point is that water samples were not collected from discharge pipes but rather from surface waters some distance below the cranberry operation discharges. Chronic and acute toxicity to two test species (water fleas) was sufficient to result in total mortality using samples collected during one of the three days. Pesticide analysis of the biomonitoring samples found diazinon at sufficient concentrations to explain the bioassay mortalities. No acute or chronic mortality was observed for another test organism, the fathead minnow. Continuous temperature recording techniques were used in the streams and showed a mean temperature increase of 3 degree C. in surface waters located downstream of the cranberry operations involved. Results of the study suggest that commercial cranberry operations may have an adverse impact on downstream water resources and warrant further investigation.

A water quality report including waters adjacent to cranberry operations in Wisconsin was prepared by the Lac du Flambeau Tribal Natural Resources Department (Moran 1992). It suggests that cranberry operations are contributing to increased nutrient loading in Little Trout Lake. Dense macrophyte and algae growth found adjacent to cranberry operation discharges may be due to the higher level of nutrients present. In some cases, cranberry marsh discharges were found to contain total phosphorus concentrations ten times higher than that of ambient lake concentrations. It is important to note that not all sample points around the lake, including mid-lake sample points, had high nutrient levels. The report also described increased levels of chlorpyrifos (a pesticide), the highest level of which exceeded the LC50 (lethal dose to 50 percent of test organisms) to *Daphnia* sp. (a water flea) by a factor of eight. Three other pesticides were detected, but concentrations of each were below toxicity levels. The report notes that the study was somewhat limited and that there is no indication that chlorpyrifos concentrations are affecting the main body of lakes; however, a concern does exist for those areas immediately adjacent to cranberry operations. Note that no significant toxicity due to chlorpyrifos in streams was found by Schreiber (1993).

In 1994, the WDNR made a grant application to EPA for a water quality study of cranberry operations. The grant was approved. The study will be a cooperative effort between WDNR and Wisconsin cranberry growers to evaluate best management practices and determine their effectiveness in reducing the potential for adverse water quality impacts due to cranberry operations.

In summary, documentation on water quality impacts of cranberry operations -- especially in regard to long-term studies -- is very limited. It is therefore difficult to make conclusive determinations of whether cranberry operations have appreciable, adverse water quality impacts.

C. GROUNDWATER STUDY

The Cranberry Institute initiated research designed to study the potential effects of pesticide application on groundwater resources. The firm of IEP, Inc. conducted the research and prepared a report on the results (IEP, Inc. 1991b). Ten sites in Massachusetts, New Jersey, Wisconsin, Oregon, Washington, and British Columbia were chosen for this study representing a variety of hydrogeologic settings for cranberry operations. The following two paragraphs were taken from the executive summary of this report:

"No significant detections of nitrates or pesticides in ground water resulting from cranberry farming activities were discovered in this investigation. Some relationships did, however, become apparent that may warrant future consideration. Variability in near surface soil characteristics and application schedules of nitrogen fertilizer should be reviewed to ensure that concentrations of these compounds remain at acceptable levels in ground water beneath these sites."

"The results of this study are the initial step in gaining an understanding of the fate of nitrates and pesticides utilized in cranberry growing. Although the results of this investigation indicate no significant adverse impact to ground water resulting from the utilization of these compounds, questions remain concerning other potential pathways along which these compounds may migrate and concentrate to higher levels. If further investigation into the potential for accumulation of nitrates and pesticides in the bog soils is considered it should be conducted in conjunction with research examining compound and sediment concentration and transport in surface water."

The study found that high peat content appears to retard leaching rates of pesticides. A letter dated May 6, 1992, from The Cranberry Institute to the Corps relating to this made the following point: Whereas the high level of organic matter in the "typical" soils of cranberry beds appears to retard agricultural chemicals from impacting groundwater, the mineral soils of cranberry beds constructed in uplands do not provide the same measure of protection in that there is a more direct pathway for chemicals to reach the

groundwater.

D. INTEGRATED PEST MANAGEMENT AND BEST MANAGEMENT PRACTICES

As stated in the introduction, growers are continually developing new techniques/technologies that are not only more cost-effective, but also have greater environmental safeguards. This includes less use of chemicals and thus less potential for adverse water quality impacts. The Integrated Pest Management (IPM) program is a prime example. IPM has three major benefits: (1) improved timing of control applications; (2) better selection of control methods; and (3) reduced applications of pesticides. Use of biological controls, such as nematodes, are also being tested and are commercially available. A comment letter from the Wisconsin Department of Agriculture, Trade & Consumer Protection (DATCP) stated that the DATCP strongly supports use of IPM programs. DATCP did clarify that IPM practices are not imposed on growers as a requirement under AG 29 of the Wisconsin Administrative Code.

Additionally, growers are developing Best Management Practices (BMP), which are an outgrowth of the IPM concept. BMP are still being developed and refined by the cranberry industry. Appendix A lists some of the BMPs that have been developed (excerpted from the 1990 *Cranberry Grower's Notebook - Wisconsin* prepared by Ocean Spray Cranberries, Inc.).

E. ST. PAUL DISTRICT ANALYSIS

Currently, the district is making permit decisions based on the best information available. The factual basis for these decisions would be strengthened by additional information because existing data concerning the water quality impacts of cranberry operations is inconclusive. The draft of this report recommended that the Corps initiate an effort to obtain funding and cooperation for a long-term (3- to 5-year) water quality study of cranberry operations. This recommendation was pursued during 1991-1992 and included coordination with the EPA, WDNR, Wisconsin State Cranberry Growers Association, The Cranberry Institute and WES. WES prepared a scope of work and cost estimates. The Corps, EPA and cranberry industry investigated sources of funds for the study, and the Wisconsin State Cranberry Growers Association (WSCGA) initiated efforts to identify growers who would be agreeable to allowing the study on their cranberry operations. The WSCGA set aside monies for the study but funding by the Federal agencies could not be arranged. The Corps made a decision that Corps monies could not be used for this type of water quality study. Furthermore, the EPA would not commit funds unless the study included testing for pesticides, while the cranberry industry representatives objected to inclusion of pesticide testing because that is the purview of the EPA's program under the Federal Insecticide, Fungicide and Rodenticide Act. Thus, the attempt to fund and implement a long-term water quality study was suspended.

Only through a comprehensive, long-term study can the data be obtained to draw valid conclusions on the water quality impacts of cranberry operations. Such a study remains a primary recommendation of this report.

V. WATER BUDGET FOR COMMERCIAL CRANBERRY PROJECTS

A. ISSUES

During review of permit applications, concerns have been expressed by landowners adjacent to proposed cranberry projects (including other growers) about the quantity of water that would be required by the project. Additionally, commenting agencies have stated concerns regarding diversion of water from streams or impounding water on wetlands. Often, the St. Paul District of the Corps, as the decision-making agency, has been unable to provide adequate answers to those concerns because the applicant had not submitted this type of information. As a result, the St. Paul District had little or no basis upon which to determine whether there was a sufficient water supply to support a proposed new or expanded cranberry operation, and to evaluate potential impacts on upstream and downstream surface waters, adjacent cranberry operations, groundwater elevations, wells, dams and septic systems.

Water is primarily used for five activities in cranberry operations: (1) frost protection; (2) irrigation; (3) chemigation; (4) harvest; and (5) winter flood (for an ice mulch). Flooding is also used in some cases as a non-chemical means of pest control. In Wisconsin, approximately 6 acre-feet/year of water is used for each acre of cranberry beds. It is important to note the major change in cranberry operations due to the installation of sprinkler systems. Prior to 1960, cranberry beds were protected from frost solely by flooding. Now, all Wisconsin growers use sprinkler systems applying water at the rate of about one-tenth inch/hour. This has reduced water use by as much as 80 percent (Eck 1990).

B. ST. PAUL DISTRICT ANALYSIS

To ensure the availability of sufficient data for sound permit decisions, the St. Paul District has had its regulatory and hydrology/hydraulics staff coordinate with a consulting engineer widely involved with Wisconsin cranberry growers to develop the attached Water Budget Data Sheet (Appendix B). Completion of this document is now a requirement of all applications for cranberry projects.

VI. ECOLOGICAL IMPACTS OF COMMERCIAL CRANBERRY PROJECTS

A. TYPES OF ECOLOGICAL IMPACTS

Cranberry operation impacts can be broken down into four parts: (1) conversion of natural wetlands to cranberry beds; (2) flooding lands for reservoirs; (3) water intake (e.g., from lakes, reservoirs, rivers) and (4) water discharge (e.g., to a lake, reservoir, river, wetland). Beds are also constructed in uplands and not all operations use reservoirs.

Approximately 7 percent of land owned by Wisconsin cranberry growers is devoted to the beds and another 3 percent is composed of the ditches and dikes (which are often used as access roads). Thus, a total of 10 percent of these lands are devoted to the system of beds/dikes/ditches. As pointed out by the cranberry industry, it is unusual to find an agricultural activity that devotes so small a percentage of land to the actual crop. Contrast this with the typical row crop (e.g., soybeans, corn) production where a very high percentage of each farm operation is used for crops.

Table 2 lists land uses of the approximately 110,000 acres owned by the approximately 150 Wisconsin growers based on a 1988 report. More recent information (Jesse et al. 1993) lists 126 growers with ownership of approximately 119,500 acres.

B. IMPACTS OF CONVERTING NATURAL WETLANDS TO CRANBERRY BEDS

In Wisconsin, cranberry beds are typically constructed in sedge meadow, alder thicket, wooded swamp and bog plant communities (see Eggers and Reed (1987) for a description of these communities). The natural water regime of these wetland plant communities is shallow standing water to saturated soils at or near the surface during all or part of the growing season. In comparison, the ditches excavated for cranberry beds allow growers to lower the water table 9 to 12 inches below the surface during the growing season, the desired condition for commercial cranberry beds. Note that sprinkler systems are used to keep the upper soil profile moist but not saturated.

The first stage in bed construction involves clearing and scalping the site, which eliminates native wetland plant communities. The material scalped from the site, and that dredged during ditch excavation, is used as fill to build dikes around each bed. Beds are usually rectangular in shape and are typically about 120 to 160 feet in width and 500 to 1,000 feet in length resulting in an average bed size of between 2 and 4 acres. A general

TABLE 2

LAND USE BY WISCONSIN CRANBERRY GROWERS

Land Use	Acres
Cranberry beds	8,679
Ditches, dikes and roads	3,500
Shallow reservoirs	23,000
Marshes and wet meadows	32,000
Shrub and wooded swamps	24,000
Forested uplands	19,000
TOTAL	110,179

From Schreiber (1988) and IEP, Inc. (1990)

rule is that for every 40 acres of land under cranberry cultivation, 30 acres are devoted to cranberry beds with the remaining 10 acres composed of ditches and dikes. Construction of the beds typically consists of placing an approximately 4- to 6-inch depth of sand fill over the scalped area to serve as a substrate for the cranberry vine cuttings.

In summary, 25 percent of the area of natural wetlands converted to cranberry beds is filled for dikes and excavated for ditches, while the remaining 75 percent is scalped, filled and partially drained. Natural wetland plant communities with various degrees of diversity are subsequently replaced by a monoculture subject to chemical applications, water level manipulations and increased human intrusion. Wildlife dependent on the native plant communities is displaced or destroyed. Sedge meadow, alder thicket, bog and wooded swamp communities are composed of one to several strata composed of populations of dozens of plant species providing niches for a diversity of wildlife species. In comparison, cranberry beds consist of a manipulated monoculture with minimal wildlife habitat value and no floristic diversity.

Additionally, Jorgensen (1992) found that the disturbance caused by the presence of commercial cranberry beds can extend into adjacent natural wetlands. Such disturbance was measurable in sedge meadows. Sand eroded from the beds and blown into adjacent

wetlands, as well as herbicide applications, were cited as reasons for disturbances extending beyond the area converted to cranberry beds.

Construction of dikes and ditches and installation of water control structures can substantially alter the water circulation patterns and hydroperiod of natural wetlands. Water can be drained, pumped, diverted and impounded by the system of dikes, control structures and ditches associated with cranberry operations. The "scope and effect" of ditches associated with cranberry operations can extend into bordering, natural wetland plant communities contributing to varying degrees of artificial drainage of those wetland communities. In some cases in Wisconsin, these types of man-made alterations have impacted hundreds of acres of wetland complexes.

In cases where the wetland proposed for conversion to cranberry beds is already highly degraded, net adverse impacts would be minimized.

C. IMPACTS OF FLOODING LANDS FOR RESERVOIRS

Approximately 21 percent of the nearly 110,000 acres of land owned by Wisconsin growers is devoted to shallow reservoirs (Schreiber 1988). Additionally, permit applications are being received by the St. Paul District proposing to create additional reservoirs. Reservoirs are usually created by impounding streams or other surface waters. In the typical situation, sedge meadow, alder thicket, bog and/or wooded swamp plant communities are flooded by the impoundment. As a result, the hydrologic regime of the affected wetland complex is greatly altered. Under permanently flooded conditions, these plant communities die out resulting in a conversion to shallow, open water habitat or, in some cases, the existing vegetation becomes a floating mat. The shallow, open water can be colonized by submergent and/or floating-leaved macrophytes and a fringe of emergent macrophytes. Upland areas can also be flooded creating new wetland/aquatic habitat.

Conversion of emergent/shrub/wooded wetlands to shallow, open water destroys or degrades the habitat of some wildlife species while enhancing or creating habitat for other species. For example, a reservoir that floods out a sedge meadow/alder thicket wetland complex would degrade or eliminate habitat for American woodcock, ruffed grouse, sedge wren and small mammals. Conversely, habitat would be created or enhanced for ducks, geese, wading birds, osprey, and warm-water fish species. Therefore, creating reservoirs cannot be characterized as strictly beneficial or detrimental. Given our example of flooding a sedge meadow/alder thicket complex, waterfowl biologists and bass fishermen would probably view the new reservoir as beneficial, whereas grouse/woodcock hunters and botanists -- concerned with the loss of native plant communities -- would probably view the proposal as detrimental.

Two specific examples illustrating the range from beneficial to detrimental impacts are ospreys and trout waters. Installation of nesting platforms in cranberry reservoirs have

resulted in establishing breeding by ospreys where none existed before. On the other hand, cranberry reservoirs have resulted in the elimination of trout in certain stretches of trout streams. In some cases trout streams themselves have been impounded, and in other cases discharges of the solar-heated reservoir water have reduced or eliminated trout in waters located downstream of the reservoir.

A basic ecological concept is that of biological diversity. In determining the balance of detrimental and beneficial impacts of a proposed reservoir, a prime consideration should be the reservoir's impact on diversity. Given a 1,000-acre expanse of sedge meadow, converting 100 acres to cranberry beds, dikes and reservoir would typically enhance diversity by creating open water (reservoir) and upland (dikes). Loss of the 100 acres of sedge meadow could be offset by the enhanced diversity, and 90 percent of the sedge meadow would remain. The other extreme is illustrated by areas where large expanses of wetland complexes have been converted to cranberry operations. Now, arguably, the pendulum has swung the other way because the substantial loss of native emergent/shrub/ wooded wetlands has made these communities increasingly more important for maintaining biological diversity.

Reservoirs, in combination with natural wetlands (marshes, wet meadows, shrub and wooded swamps) and forested uplands, compose approximately 90 percent of the 110,000 acres owned by Wisconsin growers. It is this complex where the majority of wildlife associated with cranberry operations is observed. The previously referenced IEP, Inc. (1990) study found that numerous wildlife species including common loon, double-crested cormorant, mallard, bald eagle, painted turtle, green frog and a variety of songbirds used the reservoirs. Eleven fish species were reported for the reservoirs studied including largemouth bass, black crappie, black bullhead and golden shiner. Referring to the discussion in the preceding paragraph, it is apparent that cranberry operations can possess high biological diversity. Not every cranberry operation would include all of these habitat types, but most have some of them. Klingbeil (1981) compiled a resource survey tallying the wildlife observations of growers that also illustrates the wide variety of fish, birds, mammals and other species associated with the complex of reservoirs, dikes/ditches, natural wetlands and forested uplands of cranberry areas.

Crowns (1982) states that cranberry reservoirs enhance wetlands by stabilizing water levels, a point commonly made by growers. While there can be some beneficial impacts (e.g., to fisheries), long-term stabilization of water levels is not necessarily beneficial in wetland ecosystems. Some individuals viewing wetlands during a drought and observing the dry conditions and cracked mudflats may think that wetlands are degraded or even destroyed by drought. For example, Crowns (1982) describes wetlands during a period of drought as, "...dry, browning off into areas of desolation and death for most wetland species." However, native wetland plant and animal communities have evolved with cycles of wet and drought. Periodic dry cycles and resulting mud flats allow wetland plants to recolonize areas flooded out during high water periods, and then persist with the return

of normal water levels. This is precisely the preferred condition for seed germination of some species of native wetland vegetation. Further, dry cycles allow the wetland substrate to be aerated resulting in greater decomposition of organic matter and release of nutrients. With the return of normal water levels, the nutrients released make the wetland even more productive. This dynamic nature of wetlands is stifled by man-made stabilization of water levels.

1. Best Management Practices For Reservoirs

The St. Paul District, U.S. Fish and Wildlife Service and Wisconsin Department of Natural Resources have discussed best management plans for design of cranberry reservoirs. These BMPs would increase the wildlife value of reservoirs, but cranberry growers may find that one of more of the following are not practicable given the primary purpose of the reservoir -- to store and move water for cranberry production. The following general guidelines are proposed by the agencies, but have not been approved by growers:

a. Deep ditches (or "ditch reservoirs") are undesirable because they possess the least wildlife habitat value of any of the reservoir designs. (Note: deep ditches are becoming more popular with growers and are often excavated off the toe of the reservoir dike, along the perimeter of a reservoir, or between the reservoir and beds).

b. Generally, shallow reservoirs possess the highest value for wildlife use. However, use a case-by-case review to determine the quality of wetlands and uplands that would be impacted by a reservoir. For example, in cases where high quality native plant communities are involved, it could be more desirable (less damaging) to obtain the same acre-feet of storage with a smaller, deeper reservoir to minimize flooding of high quality communities.

c. Permanent, stable water levels are generally undesirable (exceptions: can be desirable for fish, cormorants, loons and furbearers). Seasonal water level changes mimicking that of natural marshes are best (e.g., standing water for early part of the growing season gradually drying out by the end of the growing season, or drying out once every few years).

d. A series of small reservoirs is generally more desirable than one large one because more diversity is created and smaller reservoirs are easier to manage.

e. Irregular shorelines and shallow sideslopes are desirable for maximizing wildlife use of reservoirs. The type of reservoir with a deep ditch along the perimeter is discouraged (see a. above) because it eliminates "edge."

f. The reservoir should be built into the natural contours (as opposed to excavating) using shallow sideslopes. Steep sideslopes are undesirable because of lack of edge, erosion, slumping and the fact that they are more susceptible to damage by muskrats.

g. Buffer zones around the reservoirs are desirable. This could consist of leaving a strip of unmowed cover, planting wildlife food plants and restricting driving or other disturbances. The width and other factors would need to be determined on a case-by-case basis.

h. In general, "closed systems" (same source for intake and discharge) are most desirable.

D. WATER INTAKE

Water intake for cranberry operations can be from lakes, rivers, reservoirs and/or groundwater. Potential for adverse drawdown impacts is restricted to smaller, shallower surface waters and for other waters during periods of drought. Periods of maximum short-term withdrawal (e.g., harvest and winter flood) could suddenly lower water levels in these small surface waters resulting in the potential for adverse wildlife/fishery impacts. Many cranberry operations use larger surface waters where no appreciable adverse impacts usually occur even during maximum drawdown events.

E. WATER DISCHARGE

Discharges from cranberry operations can be to reservoirs, lakes, rivers and wetland complexes. Some operations use closed water systems where water intake and discharge involves the same water source. The issues surrounding discharges have been previously addressed in the discussions of IV. Water Quality Impacts of Commercial Cranberry Projects and V. Water Budget For Commercial Cranberry Projects.

F. ST. PAUL DISTRICT ANALYSIS

What is the end result of converting natural wetlands to cranberry beds? Do cranberry beds meet the criteria for wetlands under the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987): wetland hydrology, hydric soils and a plant community dominated by hydrophytes? (Note: this question is specific to that area planted with cranberry vines and excludes the surrounding dikes.) If so, should use of natural wetlands for cranberry beds be viewed as simply converting one type of wetland to another? What kind of trade-off in wetland functions and values occurs? The following discussion addresses these questions.

1. **Cranberry Beds: Wetlands Or Nonwetlands?**

a. Hydrophytic Vegetation Criteria: In its native habitat *Vaccinium macrocarpon* is an obligate hydrophyte. The draft of this report raised the question if any of the commercial varieties are better suited to nonwetland habitats (i.e., upland beds). The comments received confirmed that commercial varieties were derived from cuttings taken directly from the native or "wild" strain and should be considered obligate hydrophytes as is the native strain. Therefore, cranberry beds meet the hydrophytic vegetation parameter.

b. Hydric Soils Criteria: Beds are typically constructed in hydric soils, often peat. These hydric soils are scalped and sand fill is usually placed, but overall the soils would typically meet the definition of hydric soils -- flooded, ponded or saturated long enough during the growing season to develop anaerobic conditions in the upper part (Soil Conservation Service 1991).

c. Wetland Hydrology Criteria: Under the Corps 1987 wetland delineation manual, wetland hydrology consists of inundation or saturation to the surface for a minimum of 5 percent of the growing season in most years. Cranberry beds are flooded for part of the year. In Wisconsin the typical circumstance is that flooding of cranberry beds occurs during harvest (September-October), the winter ice mulch and spring snowmelt. Additionally, beds are flooded during spring and autumn for frost protection when temperatures are lower than 15 to 17 degrees F. At those temperatures sprinklers are no longer effective and the beds are covered with a flood from one day to several weeks at a time. The key to meeting the hydrology parameter of the 1987 manual is: are cranberry beds inundated or have saturated soils to the surface for a sufficient period of time during the growing season. Inundation during spring snowmelt and autumn occur at approximately the start and end, respectively, of the growing season. During the growing season the water table of the beds is carefully managed such that it is maintained at 9- to 12-inches below the surface of the beds and the beds are irrigated to keep the upper portion of the soil profile moist. After consideration of all factors, more evidence supports the conclusion that cranberry beds are sufficiently inundated/saturated to meet the hydrology criteria of the Corps 1987 manual.

A major regional difference is that the milder maritime climates of Massachusetts, New Jersey and the Pacific Northwest result in much longer growing seasons than that of Wisconsin. For example, the Portland District of the Corps reported (letter dated January 3, 1991, to the St. Paul District) that the growing season is essentially year-round for coastal dune cranberry beds. In this case it is obvious that cranberry beds are inundated or have saturated soils during the growing season sufficient to meet the wetland hydrology criterion.

d. Cranberry Beds As "Cropped Wetlands": Cranberry beds are wetlands -- they are most accurately referred to as "cropped wetlands" due to the intensive agricultural manipulation associated with maximizing cranberry production. The Wisconsin Wetland Inventory, prepared by the Wisconsin Department of Natural Resources, has mapped cranberry beds as wetlands using a special modifier, as has the National Wetland Inventory (NWI), prepared by the U.S. Fish and Wildlife Service. Tiner and Zinni (1988) used NWI criteria for comparing wetland trends in southeastern Massachusetts and also considered cranberry beds to be "farmed wetlands," which is comparable to "cropped wetlands."

2. Wildlife Use of Cranberry Beds and Associated Dikes/Ditches

A study of three Wisconsin cranberry operations found that cranberry beds were the least valuable wildlife habitat of lands associated with cranberry operations (IEP, Inc. 1990). Most of the wildlife used the reservoirs, adjacent wetlands, dikes/ditches, etc. Wildlife that did use the beds included green frogs, meadow voles, red fox, white-tailed deer and a number of bird species (IEP, Inc. 1990).

The same study found that a greater number of wildlife species used the dikes/ditches including Canada geese, green-winged teal, great blue heron, turtles, snakes, several species of sandpipers and a number of small mammal species. It is the observation of St. Paul District staff that potential use of the dikes as nesting habitat or wildlife cover is frequently limited because of the steep slopes, use as roads and little (often mowed) vegetation.

The IEP Inc. (1990) study states that their "... preliminary baseline data indicate that wildlife use and diversity may well be decreased by conversion of natural wetlands or uplands to cranberry beds. However over the entire site, wildlife use and diversity may increase due to the creation of open water areas (reservoirs), ditches, forest openings (edge), and disturbed areas..."

Jorgensen (1992) studied the wildlife diversity and habitat of five commercial cranberry operations located in central Wisconsin. Vegetation, mammals, birds, fish, herpetofauna and aquatic invertebrates were addressed. Wildlife use of reservoirs and cranberry beds as well as adjacent natural wetlands were studied. Over 100 species of birds were observed within areas used for commercial cranberry operations. Avian species were measurably affected by the edge associated with the intersection of cranberry beds and adjacent natural wetlands. Seven species of birds seemed to select for the habitat provided by cranberry beds, while 12 species were indifferent to this habitat and 58 species seemed to select against using the cranberry beds. Most mammals selected against using the beds as habitat.

3. Wetland Functions and Values of Cranberry Beds

Important wetland functions and values include: (a) wildlife habitat; (b) support of native plant communities; (c) water quality benefits; (d) floodwater/stormwater attenuation; (e) aesthetic, recreational and educational opportunities; and (f) habitat for rare, threatened and endangered species. Although cranberry beds meet the technical criteria for wetlands, their functions and values can be very different and diminished compared to natural wetlands as summarized by the following discussion.

a. Wildlife Habitat: As previously discussed, the IEP, Inc. (1990) study of three Wisconsin cranberry operations, and the Jorgensen (1992) study of five Wisconsin cranberry operations, found cranberry beds to be the least valuable wildlife habitat of lands associated with cranberry operations. Deer-proof electric fencing, hazing (e.g., using noisemakers), trapping, and other measures are sometimes used in an attempt to exclude wildlife usage of the beds (Wisconsin State Cranberry Growers Association 1992). Overall, conversion of natural wetlands to cranberry beds results in diminished use by wildlife.

b. Support Of Native Plant Communities: Wetland plant species, other than cranberries, that colonize cranberry beds are "weeds" and are subject to herbicide applications and other measures in attempts to eradicate them.

c. Water Quality Benefits: Conversion of natural wetlands to cranberry beds results in an increase in use of chemicals within wetland systems because of the application of fertilizers and pesticides associated with cranberry beds. This may or may not have deleterious impacts on the water quality of adjacent streams and lakes, as well as groundwater.

d. Floodwater/Stormwater Attenuation: Because of their diked and controlled water distribution system, cranberry beds function very differently than natural wetlands for floodwater/stormwater attenuation. Any beneficial floodwater or stormwater attenuation would be incidental to use of the beds for maximizing berry production.

e. Aesthetic, Recreational And Educational Opportunities : Perceptions vary as to whether cranberry beds or natural wetlands are more or less aesthetically pleasing. Recreational opportunities would be greater for natural wetlands because of hiking, hunting, camping, snowmobiling, nature photography and similar activities. These types of activities would generally not be compatible with cranberry beds.

f. Habitat For Rare, Threatened And Endangered Species : Habitat for these species can be provided by natural wetlands whereas this is usually not the case with cranberry beds.

4. Summary

While cranberry beds remain wetlands, they are "cropped wetlands" consisting of a monoculture subject to intensive manipulation for maximizing cranberry production. Most of the functions/values of natural wetlands are lost or substantially reduced by conversion to cranberry beds. Intensive measures are undertaken to suppress biodiversity -- weedy cranberry beds and abundant wildlife use would be counterproductive to the goal of maximizing berry production.

Filling for dikes and roads typically results in a permanent loss of wetlands. Flooding natural wetlands to create reservoirs results in losses of existing forested, shrub and wet/sedge meadow plant communities and the functions/values they provide. Additionally, water circulation patterns and hydroperiod of existing wetland complexes can be substantially altered within and beyond the system of dikes, ditches, beds and impoundments of cranberry operations.

As noted above, the IEP Inc. (1990) study did find that the overall complex of reservoirs, ditches, natural wetlands, forest, dikes, beds, etc., can increase habitat diversity and wildlife use. However, the majority of acreage involved in cranberry projects in Wisconsin consisted of conversion of natural wetlands to cranberry beds, the least valuable wildlife habitat associated with cranberry operations.

In order to make a conclusive comparison as to whether functions and values are decreased or increased by cranberry operations, it would be necessary to compare the pre-project functions and values of natural wetlands at a particular site with the functions and values present after its conversion to a cranberry operation. Many site-specific factors would weigh in the analysis as to the overall increase or decrease in wetland (and upland) functions and values. For example, is the area to be permanently flooded for a cranberry reservoir composed of an artificially drained area considered prior converted cropland, or is it composed of an old growth wooded swamp?

VII. COMPENSATORY MITIGATION FOR COMMERCIAL CRANBERRY PROJECTS

A. COMPENSATING FOR UNAVOIDABLE WETLAND IMPACTS

The preceding section VI. described the adverse impacts associated with conversion of natural wetlands to beds, dikes and reservoirs. To offset unavoidable losses of wetland functions/values, compensatory mitigation is necessary similar to that required for other types of wetland impacts associated with issuance of Section 404 permits.

The objective of compensatory mitigation is to replace the wetland functions and values lost or reduced due to a Section 404 authorized activity. Specific to cranberry projects that convert natural wetlands, some commentors asserted that compensatory mitigation should be at a ratio of less than 1.0:1.0 (one acre of compensatory mitigation for each acre lost or converted) because the end result -- cranberry beds -- are wetlands, albeit cropped wetlands. An example given was a development project that converted wetlands to a building and parking lot leading to a total loss of wetland functions and values. Cranberry reservoirs and ditches can provide important wetland functions and values, but what wetland functions and values do cranberry <u>beds</u> provide? This is important because the majority of projects and acreage of wetland impacts involve converting natural wetlands to cranberry beds, not reservoirs or ditches. While cranberry beds meet the technical criteria for wetlands under the Corps 1987 wetlands delineation manual, there is little to no correlation between the functions and values of cranberry beds compared to those of natural wetlands as summarized on pages 27 to 29. The overriding purpose of cranberry beds is to maximize fruit production of a single species of hydrophyte. This comes at the expense of most other functions and values possessed by natural wetlands. Therefore, in order to achieve the objective of replacing the functions and values of natural wetlands due to conversion to cranberry beds, little to no compensatory mitigation credit can be given for cranberry beds whether constructed in wetlands or uplands.

For these reasons, compensatory mitigation for conversion of natural wetlands to cranberry beds starts at a ratio of 1.0:1.0. This ratio can be increased or decreased as appropriate on a case-by-case basis. For example, compensatory mitigation requirements can be reduced if the natural wetlands to be converted to cranberry beds are so degraded that they provide minimal wetland functions and values. Conversely, if high quality wetlands are impacted by conversion to cranberry beds, a higher ratio may be appropriate.

B. ST. PAUL DISTRICT ANALYSIS

1. Conversion of natural wetlands to beds, ditches and dikes results in the loss of wetland functions and values. Mitigation is required in accordance with the Corps/EPA Memorandum of Agreement (MOA) implemented on February 7, 1990. Avoidance of wetland impacts (e.g., locating proposed beds in uplands) is the first objective, followed by minimization and lastly, compensation. Mitigation requirements necessary to offset unavoidable adverse impacts would be determined on a case-by-case basis to account for the variables that exist for each site and cranberry operation. The ratio of replacement starts at a ratio of 1.0:1.0 (acres of mitigation: acres impacted). This analysis, like the aforementioned MOA, recognizes that it may not be feasible to achieve the goal of no net loss of wetland functions and values in every permit action.

2. No mitigation credit is given for conversion of uplands to cranberry beds for the reasons stated in VII.A. above.

3. Special emphasis is placed on avoidance of adverse impacts to trout streams, wild and scenic rivers, scientific and natural areas (including areas ranked as NA-1, NA-2 and NA-3), and other high quality natural resources. For example, to avoid discharge of solar-heated reservoir water to a trout stream, a closed system (no discharge to the stream) could be required.

4. Reservoirs usually result in a trade-off involving detrimental impacts to some wildlife species and beneficial impacts to other species. A case-by-case analysis is required to balance the benefits and detriments of a proposed reservoir. For example, if the reservoir would create or enhance wetland/aquatic habitat by flooding low quality wetlands and/or uplands, mitigation credit could be given for the acreage created/enhanced. However, if the reservoir would flood valuable habitat(s) no mitigation credit is given and compensatory mitigation may be required to replace the wetland functions and values lost.

5. The need for a reservoir (using information such as the Water Budget Data Sheet -- Appendix B) will be scrutinized to determine if feasible alternatives exist to avoid or minimize adverse impacts.

6. The St. Paul District is open to discussing the feasibility of establishing a compensatory mitigation bank(s) for cranberry growers. It must be clearly understood, however, that a bank would be applicable only to projects where the avoidance and minimization criteria have been satisfied. Mitigation banking guidelines for use by the Federal agencies are being reviewed and finalized.

VIII. SECTION 404(F) EXEMPTIONS FOR COMMERCIAL CRANBERRY PROJECTS

Section 404(f) of the Clean Water Act lists a group of activities that are exempt from regulation. It also contains a "recapture" clause stating that a permit will be required for any of those activities if its purpose is to bring an area into a new use or if it would reduce the reach of waters of the U.S. Corps regulations address the application of Section 404(f) at 33 Code of Federal Regulations Part 323.4. An integrated reading of the Clean Water Act regulations results in the following guidelines, which supersede the St. Paul District's 1981 policy.

A. APPLICATION OF 404(F) EXEMPTIONS FOR WORK IN CRANBERRY BEDS AND RESERVOIRS

1. The discharge of dredged or fill material in waters of the U.S., including wetlands, for construction of new cranberry beds or expansion of existing beds requires a permit because it would bring an area into a new use or increase the area of established use.

2. The discharge of dredged or fill material in waters of the U.S. for the repair, rehabilitation, reconstruction or realignment of beds within an area of established use does not require a permit. This includes placement of sand "lifts" on existing beds and applies to maintenance of existing perimeter dikes and ditches.

3. The discharge of dredged or fill material in waters of the U.S. for construction of new reservoirs, or raising dikes that expand the surface area of an existing reservoir, or increasing capacity of ditches or reservoirs, requires a permit.

4. The discharge of dredged or fill material in waters of the U.S. for repair, rehabilitation or reconstruction of reservoir dikes and ditches within an area of established use does not require a permit. This applies to maintenance to original dimensions.

5. The discharge of dredged or fill material in waters of the U.S. for construction of reservoir dikes and ditches within an area of established use for the purpose of manipulating water levels, or regulating the flow or distribution of water, does not require a permit.

B. DEFINITION OF AREA OF ESTABLISHED USE

1. For A.1. and A.2. above, area of established use is that area currently occupied by beds planted with vines and possessing a functioning water distribution system. Perimeter dikes and perimeter ditches are included in this area of established use. If abandoned for more than five years, the area will no longer be considered an area of established use. If wetlands exist within the abandoned area, any discharges associated with bringing it back into cranberry production will require a permit.

2. For A.3., A.4. and A.5. above, the area of established use is that within the ordinary high water mark (OHWM) of the reservoir as established by the control structures, dikes and ditches. In cases where reservoirs have been constructed in extensive wetland complexes with little opportunity for leaving shelving, drift lines or other indicators of OHWM, the area of open water created by the impoundment can be used to determine the area of established use. Survey data may be necessary to establish the area encompassed by the OHWM.

C. APPLICATION OF 404(F) EXEMPTIONS FOR WORK IN SANDPITS ASSOCIATED WITH CRANBERRY OPERATIONS

On June 12, 1995, the national headquarters of the Corps and EPA issued a memorandum addressing the applicability of exemptions under Section 404 to certain normal farming activities associated with cranberry production. Specifically, it addressed "sanding" activities as part of an on-going cranberry operation. This includes extracting sand from existing pits, interim storage of sand, and placement of sand in cranberry beds. Sanding is an integral part of cranberry cultivation and is done by growers to stimulate production of upright (fruit-bearing) shoots, promote rooting of long runners, maintain soil acidity, regulate the temperature of beds, and implement integrated pest management practices. The latter can reduce the need for chemical pesticides that can adversely impact water quality.

The following is taken directly from the June 1995 memorandum:

"The landscape historically chosen for cranberry production provides the essential soil and water characteristics, as well as for practical considerations, a reliable source of sand located adjacent to the cranberry beds. In some of the existing cranberry operations in Wisconsin, the cranberry beds, sand extraction pits, and interim storage areas are located in waters of the United States. In such circumstances where sand extraction and interim storage areas currently exist on the site of an on-going cranberry farming operation, such activities are part of a normal on-going farm practice and therefore are exempt from regulation under Section 404 (f)(1)(A), with the following limitations:

1. Sand extraction must be part of an established cranberry farm and must be excavated from an existing pit. The pit may be expanded to contiguous areas commensurate with the farm needs under the exemption.

2. All excavated materials are used exclusively within the existing farm operation for the sanding of cranberry beds and farm related activities. For related farm activities, this memorandum does not authorize discharges into waters of the U.S. that would otherwise require a permit under Section 404.

3. The footprint of the sand extraction pit remains waters of the United States.

4. Interim storage areas are not used as the basis for permanent conversion of waters of the United States.

It is important to emphasize that any new sand collection areas must be situated in upland areas or be permitted in accordance with Section 404. Moreover, any permanent conversions of waters of the United States to uplands would be subject to recapture under Section 404 (f) (2) and require a permit."

IX. POLICY IMPLICATIONS OF UNITED STATES v. HUEBNER

In United States v. Huebner (752 F.2d 1235 (1985)), a statement was made that "...cranberry beds are compatible with wetlands...". This could be construed as contradicting some of the statements made herein. However, the Court's intent is clarified by its qualifications and by considering the quote in its proper context, i.e., "...cranberry beds are compatible with wetlands, although they do not perform the same water filtration and storage functions as an undisturbed wetland." Furthermore, the court's holding is applicable only under the facts and circumstances set forth in the Huebner case wherein the court decided not to order restoration of wetlands that had been converted into cranberry beds without Section 404 authorization.

X. CONCLUSION

The preceding discussions of the major issues involving Section 404 and cranberry activities led to the following conclusions:

- Cranberry beds and associated structures are water dependent activities within the narrow meaning of the 404(b)(1) guidelines. This means that the rebuttable presumptions contained in the guidelines do not apply; however, it is still necessary for each project to satisfy the demonstration that it is the least environmentally damaging, practicable alternative (see Appendix C). The applicant must first demonstrate that avoidance and minimization of adverse wetland impacts are not practicable. New cranberry operations in wetlands should be scrutinized to a greater degree than expansions of existing operations, as should any cranberry project that would impact high value or sensitive natural resources (e.g., trout streams, scientific and natural areas, etc.). In cases where the applicant successfully demonstrates that an upland alternative is not practicable, and unavoidable adverse impacts are mitigated for, a permit to convert wetlands to cranberry beds would be issued assuming all other factors of the project are not contrary to the public interest.

- Cranberry beds are wetlands under the Federal methodology (Environmental Laboratory 1987) and are best described as "cropped wetlands" due to their intensive use for crop production.

- Conversion of natural wetlands to cranberry beds results in: (1) a permanent loss of wetlands due to filling for construction of dikes/roads; and (2) a loss or significant degradation of wetland functions/values[2].

- Flooding existing wetlands to create reservoirs exchanges the functions and values of one for those of the other. Some functions/values are lost or degraded, while others are created or enhanced. An evaluation is necessary to balance the overall benefits and detriments in order to determine whether mitigation is required to offset adverse impacts of flooding existing wetlands.

[2]If abandoned, cranberry beds typically revert to natural wetland plant communities. If the dike fill sinks or gradually disintegrates over the years, the former footprint of dike fill may also revert to wetland characteristics.

- Compensatory mitigation is required to offset unavoidable adverse impacts of construction beds, dikes and reservoirs in wetlands to the extent practicable. The ratio of replacement starts at 1.0 acre/1.0 acre.

- Compensatory mitigation credit can be given for creation of wetlands due to flooding uplands, but caution should be exercised to avoid adversely impacting high value uplands. Credit is not given for creating cranberry beds in uplands since beds do not provide wetland functions and values comparable to natural wetlands.

- Continued efforts by the cranberry industry and regulatory agencies are encouraged to refine and develop best management practices for all phases of cranberry operations. These will serve to minimize concerns/controversy involving issuance of permits for cranberry projects.

- Permit applications for cranberry projects need to include a water budget so that the impacts to surface waters (and groundwater) can be assessed. This requirement has been in effect in the St. Paul District since the draft of this report was prepared.

- Implementation and completion of a systematic, long-term, scientifically valid water quality study of cranberry operations is needed to more fully evaluate water quality impacts.

These Guidelines Are Effective As Of The Date Of Publication Of This Document

GLOSSARY

404(b)(1) guidelines: U.S. Environmental Protection Agency guidelines for evaluating the impacts of the discharge of dredged or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act (see 40 CFR 230).

CFR: Code of Federal Regulations

compensatory mitigation: Refers to actions taken to offset or compensate for adverse impacts. Under the Section 404 permit program, compensatory mitigation can include restoration of previously drained or filled wetlands, creation of wetlands by flooding uplands, or implementation of techniques to enhance existing wetlands.

growing season: That portion of the year when soil temperatures are above biologic zero (41 degrees F.) at 19.7 inches below the surface. It can be approximated by the number of frost-free days.

hydric soils: Soils that are saturated, flooded, or ponded for long enough periods during the growing season to develop anaerobic conditions in the upper part.

hydrophyte: (i.e., water plant) A plant growing in water or on a substrate that is at least periodically deficient in oxygen due to excessive water content.

inundated: A condition in which water temporarily or permanently covers a land surface.

mitigation bank: Restoration, creation, enhancement and, in exceptional circumstances, preservation of wetlands and/or other aquatic resources expressly for the purpose of providing compensatory mitigation <u>in advance</u> of authorized impacts to similar resources. It can be likened to a bank account where mitigation "credits" (e.g., acres of wetlands restored or created) can be established and then withdrawn (debits) at a later time as the need arises.

MOA: Memorandum of Agreement

ordinary high water mark: A line on the shore established by fluctuations of water indicated by physical characteristics such as a natural line impressed on the bank; shelving; changes in the character of the soil; destruction of terrestrial vegetation; the presence of litter or debris; or other measures.

practicable: Means available and capable of being done after taking into consideration cost, existing technology and logistics in light of overall project purpose.

RGL: Regulatory guidance letter issued to Corps of Engineers and EPA staff.

saturated: A condition in which all easily drained pores between soil particles are temporarily or permanently filled with water.

Section 404: Part of the Federal Clean Water Act that pertains to regulating the discharge of dredged or fill material in waters of the United States. The program is administered by the U.S. Army Corps of Engineers with oversight by the U.S. Environmental Protection Agency.

Section 401: Part of the Federal Clean Water Act requiring certification that a Federal license or permit would not violate state water quality standards.

upland : Areas lacking the hydrologic conditions necessary for the development of hydric soils and dominance by hydrophytes.

wetland: Areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328).

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APPENDIX A

BEST MANAGEMENT PRACTICES[1]

[1]Excerpted from the 1990 *Cranberry Grower's Notebook - Wisconsin* prepared by Ocean Spray Cranberries, Inc.

BEST MANAGEMENT PRACTICES

The Code of Federal Regulations (*Title 40, Protection of the Environment*) defines Best Management Practices (*BMP*) as "*A practice, or combination of practices, that is determined ... to be the most effective, practicable (including technological, economic, and institutional) means of preventing or reducing the amount of pollution generated ...*" More simply put, BMP's include both crop and land management practices which help reduce or prevent nonpoint pollution.

There is no such thing as one universal best management practice to eliminate, reduce or minimize potential pollution. There are, however, many practices that, when taken collectively, can significantly contribute to an even better environment, without sacrificing crop yield or quality. Farmers have been practicing many of these common-sense techniques for years, and listed below are some commonly accepted BMP's:

Practice Integrated Pest Management (*IPM*), which combines biological (*B.t. and nematodes*), cultural (*i.e., late water, destruction of pest breeding areas by mowing*), and chemical controls.

Apply pesticides according to pest pressure, not the calender.

Use pesticides only when needed and only in the amounts required (*will 1.5 or 2 pts. Lorsban work instead of 3 pts.?*).

Follow label directions, and comply with all federal and state laws regulating pesticides.

Keep accurate records.

Make material safety data sheets *(MSDS)* accessible.

Identify nearby water sources for contamination vulnerability.

Keep pesticides away from water sources while handling, loading, or mixing.

If known, use the pesticide that will control the target pest which is "easier" on the environment (*less likely to leach, less toxic to people, fish and birds- see the end of Tab Section 6 for some suggestions*).

Mix accurately, and calibrate and maintain equipment properly.

Avoid spills and back-siphoning, follow chemigation regulations *(see Tab Section 8).*

Develop a plan in case of pesticide emergencies *(see Tab Section 10; consult your area extension agent, field representative, or Grower Relations for information).*

Reduce drift as much as possible; apply only during low winds and use a drift-retarding agent.

Dispose of pesticides properly - triple-rinse and return the rinse water to the spray tank so that it is applied onto the crop.

Return triple-rinsed containers, if possible, to your local pesticide dealer.

Store pesticides properly - in their original container in a cool, well-ventilated, protected location away from water sources.

Practice good water conservation - avoid excessive irrigation; delay heavy irrigation after pesticide and nutrient application (*for 1 day or more*) to minimize leaching and runoff.

Wells themselves can cause groundwater contamination- properly seal new wells and inspect old wells to insure that the seal is adequate.

Employ good nutrient management techniques-

- Use soil and plant testing when appropriate.
- Select proper time and method of application to coincide with periods of plant demand to reduce losses from leaching or runoff.
- To reduce the risk of nitrate leaching, do not apply nitrogen fertilizer on sandy beds during the fall.
- Base fertilizer applications rates on realistic yield goals.
- Apply nutrients in small multiple applications, rather than in one large application, to help reduce nutrient loss.

The installation of buffer strips adjacent to surface waters receiving drain age from active beds reduces the chance of sediment, nutrient, and pesti cide runoff.

In addition to the above best management practices, listed below are some additional recommendations, many of which were developed by the Wisconsin Cranberry Growers Association, and which are more specific to cranberry growing.

Always check the area to be treated and surrounding areas to make sure they are clear of people and pets.

Regardless of the method of pesticide application (*chemigation, aerial, ground equipment*), every effort should be made to **keep the pesticide** confined to the cranberry bed and **out of open or running water.**

Before making an application, the **beds should be** allowed to **dry** off as much as possible.

All waters in contact with the beds **should be retained** for the length of time required by the label and, if possible, **as long as possible** to allow maximum degradation.

Flumes and water control structures should be properly installed and main tained to prevent water from flowing off-site and entering receiving waters.

If water can not be retained for the appropriate period of time, then:

i) water control structures or system layout should be improved

ii) a different pesticide, or pest control strategy, should be used.

Pesticide and nutrient applications should not be made when significant precipitation is expected which could contribute to pesticide and nutrient discharge.

As more research becomes available to support future best management practices recommendations for cranberry growing, the above lists will be updated.

APPENDIX B

WATER BUDGET DATA SHEET

WATER BUDGET DATA SHEET

Directions: It is recognized that each cranberry operation is unique in regard to the source of water, layout, etc. Answer only those questions that pertain to your proposal (i.e., if your cranberry operation has a river as its water source, answer the questions under River/Stream and ignore those under Groundwater and Lake). On separate sheets of paper, be sure to show all calculations and explain all assumptions and sources of information.

I. DESCRIBE YOUR WATER SOURCE(S)

A. River/Stream

1. Use gaging data if available; if not available, provide best calculations based on drainage area, land use, etc., or data from a similar stream and watershed located as near as possible to the project site.

   a. Average annual flow in cubic feet per second (cfs) _______

   b. CFS flow and elevation for 100-year flood event ________

   c. 7Q10 flow (lowest 7-day flow in a 10-year period) _______
   7Q2 flow (lowest 7-day flow in a 2-year period) _________

   d. Quantify the anticipated stream diversion, cfs/day, number of days.

2. Provide a map (to scale, 1"=1,000') showing that portion of the project area within the 100-year floodplain and/or floodway.

3. Cross-sectional drawing of the stream, upstream and downstream of the operation, showing water level at average annual flow and at 7Q2 and 7Q10.

B. Lake/Reservoir

1. What is the surface elevation, surface acreage and acre-feet (AF) of storage of the lake/reservoir during:

   a. Average conditions;

   b. High water conditions;

   c. Drought conditions (e.g., 1976 and 1988).

2. Is the lake/reservoir isolated or connected to other lakes and/or river systems? Describe. Provide map as appropriate.

C. Watershed Information

a. Size (acres or square miles) ________

b. Average slope of watershed ________

c. Characterize soils of the watershed (% peat, % sand, % clay, % impervious surfaces, etc.) using the county soil survey (if none has been prepared for your county, provide best available information).

d. Characterize land use of the watershed (% upland forested, % wetland, % lakes, % cranberry reservoirs, % cranberry beds, % agricultural (other than cranberry), % urban, etc.)

e. If there are existing cranberry reservoir(s) on site, upstream or downstream, at what distance from the project area are they located, and what is the surface elevation, surface acreage and AF of storage capacity of each during:

(1) Average conditions;

(2) High water conditions;

(3) Drought conditions (e.g., 1976 and 1988).

D. Groundwater

1. Average depth to watertable ______________

2. Describe springs and seeps (e.g., number, location, estimated flow (in gallons per minute (gpm), etc.)

3. Describe the permeability rate of the soil(s) involved at your site (refer to county soil survey information).

If your plans include reservoir construction or enhancement, include the permeability rate of soils in the reservoir area. If a county soil survey is not available, representative core samples of the reservoir area should be taken so that soil permeability can be estimated.

II. DESCRIBE HOW YOUR WATER SUPPLY SYSTEM WOULD WORK

A. What would be your total water supply (in AF) combining river/stream, lake/reservoir and/or groundwater sources? What percentage would each contribute to your water supply?

B. If your proposal is an expansion of an existing cranberry operation, describe how the proposed expansion would tie in.

C. Where would water be discharged to (if more than one give percentages for an average year):

1. Reservoir(s), (if a reservoir is used as a temporary detention basin, please indicate and estimate detention time);

2. Natural lake;

3. Stream/River;

4. Wetland complex.

Identify the location of each discharge point on the site plan and indicate frequency and duration of discharge.

III. WATER USE

The following averages have been determined to be reasonably accurate for that portion of Wisconsin where most cranberry operations are located. Use these figures unless you have more site-specific information. The questions pertain to water usage in one year of operation.

1. Average annual water use: 6 AF per acre of cranberry beds

2. Average annual precipitation: 30 inches

3. Average annual evapotranspiration: 21 inches

4. Net runoff: 9 inches

A. Water requirements of your cranberry operation (acres of beds x 6 AF), both proposed and existing (if applicable) ________________

B. Estimate, in AF and percentage of total water use, how much water would be reused (i.e., pumped back into reservoir), during what time period;

C. Estimate how much water would be lost due to seepage;

D. Estimate AF of water lost due to discharge out of cranberry operation (i.e., to river or lake);

E. Complete a balance sheet showing water sources for your cranberry operation (river, lake, reservoir, groundwater, net precipitation, etc.) and subtracting water uses (6 AF per bed, seepage, discharged outside of cranberry operation, etc.). This should be calculated for a one year period assuming average conditions.

IV. IMPACT ANALYSIS

A. River/Stream Water Source

1. Provide a water quantity analysis evaluating the in-stream impacts, both upstream and downstream, of withdrawing water for your cranberry operation.
2. Under a worse case situation, such as the drought of 1976 or 1988, what percent of the cfs flow of the river/stream would be diverted to your cranberry operation?

Use cross-sectional drawings similar to those in part I.A.3. to show downstream water levels under average conditions and at 7Q2 with the proposed project in place.

B. Lake/Reservoir Water Source

1. How much would the surface elevation be lowered during the maximum short-term withdrawal (e.g., putting on the winter flood)?

2. If a reservoir (impoundment) is used, what is the distance and difference in elevation to the nearest occupied buildings located downstream as well as laterally (adjacent to the reservoir) considering both those on your property as well as neighboring properties.

C. Groundwater Water Source

Describe the effect on the groundwater elevation due to proposed dikes, reservoirs, etc. (e.g., would the proposed reservoir raise the groundwater elevation? If so, how much?)

D. Summary

Describe how your water use could affect neighboring property owners. How would your operation affect other users both upstream and downstream: wildlife refuges, recreational areas, public or private water supplies, other cranberry operations, other agricultural uses.

APPENDIX C

REGULATORY GUIDANCE LETTER

CRANBERRIES AND WATER DEPENDENCY

US Army Corps
of Engineers
ce, Chief of Engineers

Regulatory Guidance Letter

No. 92-2 Date 26 June 92 Expires 31 Dec 95

CECW-OR

SUBJECT: Water Dependency and Cranberry Production

1. Enclosed for implementation is a joint Army Corps of Engineers/Environmental Protection Agency Memorandum to the Field on water dependency and cranberry production. This guidance was developed jointly by the U. S. Army Corps of Engineers and the U. S. Environmental Protection Agency.

2. This guidance expires 31 December 1995 unless sooner revised or rescinded.

FOR THE DIRECTOR OF CIVIL WORKS:

Encl

JOHN P. ELMORE, P.E.
Chief, Operations, Construction
and Readiness Division
Directorate of Civil Works

United States Environmental Protection Agency
Office of Water
Washington, D.C. 20460

Department of the Army
U.S. Army Corps of Engineers
Washington, D.C. 20314-1000

26 JUN 1992

MEMORANDUM TO THE FIELD

SUBJECT: Water Dependency and Cranberry Production

1. The purpose of this memorandum is to clarify the applicability of the Section 404(b)(1) Guidelines water dependency provisions (40 CFR 230.10(a)) to the cultivation of cranberries, in light of Army Corps of Engineers (Corps) regulations at 33 CFR 323.4(a)(1)(iii)(C)(1)(ii) and (iii), and Environmental Protection Agency (EPA) regulations at 40 CFR 232.3(d)(3)(i)(B) and (C). These sections of the Corps and EPA regulations state, among other things, that cranberries are a wetland crop, and that some discharges associated with cranberry production are considered exempt from regulation under the provisions of Section 404(f) of the Clean Water Act. The characterization of cranberries as a wetland crop has led to inconsistency in determining if cranberry production is a water dependent activity as defined in the Section 404(b)(1) Guidelines (Guidelines).

2. The intent of Corps regulations at 33 CFR 320.4(b) and of the Guidelines is to avoid the unnecessary destruction or alteration of waters of the U.S., including wetlands, and to compensate for the unavoidable loss of such waters. The Guidelines specifically require that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences" (see 40 CFR 230.10(a)). Based on this provision, an evaluation is required in every case for use of non-aquatic areas and other aquatic sites that would result in less adverse impact to the aquatic ecosystem, irrespective of whether the discharge site is a special aquatic site or whether the activity associated with the discharge is water dependent. A permit cannot be issued, therefore, in circumstances where an environmentally preferable practicable alternative for the proposed discharge exists (except as provided for under Section 404(b)(2)).

3. For proposed discharges into wetlands and other "special aquatic sites," the Guidelines alternatives analysis requirement further considers whether the activity associated with the proposed discharge is "water dependent". The Guidelines define water dependency in terms of an activity requiring access or

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proximity to or siting within a special aquatic site to fulfill its basic project purpose. Special aquatic sites (as defined in 40 CFR 230.40-230.45) are: (1) sanctuaries and refuges; (2) wetlands; (3) mud flats; (4) vegetated shallows; (5) coral reefs; and (6) riffle and pool complexes. If an activity is determined not to be water dependent, the Guidelines establish the following two presumptions (40 CFR 230.10(a)(3)) that the applicant is required to rebut before satisfying the alternatives analysis requirements:

a. that practicable alternatives that do not involve special aquatic sites are presumed to be available; and,

b. that all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem.

It is the responsibility of the applicant to clearly rebut these presumptions in order to demonstrate compliance with the Guidelines alternatives test.

4. If an activity is determined to be water dependent, the rebuttable presumptions stated in paragraph 3 of this memorandum do not apply. However, the proposed discharge, whether or not it is associated with a water dependent activity, must represent the least environmentally damaging practicable alternative in order to comply with the alternatives analysis requirement of the Guidelines as described in paragraph 2 of this memorandum.

5. As previously indicated, Corps and EPA regulations consider cranberries as a wetland crop species. This characterization of cranberries as a wetland crop species is based primarily on the listing of cranberries as an obligate hydrophyte in the National List of Plant Species That Occur in Wetlands (U.S. Fish and Wildlife Service Biological Report 88(26.1 - 26.13)) and the fact that cranberries must be grown in wetlands or areas altered to create a wetland environment. Therefore, the Corps and EPA consider the construction of cranberry beds, including associated dikes and water control structures associated with dikes (i.e., headgates, weirs, drop inlet structures), to be a water dependent activity. Consequently, discharges directly associated with cranberry bed construction are not subject to the presumptions applicable to non-water dependent activities discussed in paragraph 3 of this memorandum. However, consistent with the requirements of Section 230.10(a), the proposed discharge must represent the least environmentally damaging practicable alternative, after considering aquatic and non-aquatic alternatives as appropriate. To be considered practicable, an alternative must be available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. For commercial cranberry cultivation, practicable alternatives may include upland sites with proper characteristics for creating the

necessary conditions to grow cranberries. Factors that must be considered in making a determination of whether or not upland alternatives are practicable include soil pH, topography, soil permeability, depth to bedrock, depth to seasonal high water table, adjacent land uses, water supply, and, for expansion of existing cranberry operations, proximity to existing cranberry farms. EPA Regions and Corps Districts are encouraged to work together with local cranberry growers to refine these factors to reflect their regional conditions.

6. In contrast, the following activities often associated with the cultivation and harvesting of cranberries are not considered water dependent: construction of roads, ditches, reservoirs, and pump houses that are used during the cultivation of cranberries, and construction of secondary support facilities for shipping, storage, packaging, parking, etc. Therefore, the rebuttable practicable alternatives presumptions discussed in paragraph 3 of this memorandum apply to the discharges associated with these non-water dependent activities. However, since determinations of practicability under the Guidelines includes consideration of cost, technical, and logistics factors, determining the availability of practicable alternatives to discharges associated with these non-water dependent activities must involve consideration of the need of an alternative to be proximate to the cranberry bed in order to achieve the basic project purpose of cranberry cultivation. Once it has been determined that the location of the cranberry bed, including associated dikes, and water control structures, represents the least environmentally damaging practicable alternative, practicable alternatives for maintenance roads, ditches, reservoirs and pump houses will generally be limited to the bed itself and the area in the vicinity of the actual bed. For example, the bed dikes may be the only practicable alternative for location of maintenance roads. When practicable alternatives cannot be identified within such geographic constraints, the applicant must minimize the impacts of the roads, reservoirs, etc., to the maximum extent practicable.

7. During review of applications for discharges associated with cranberry cultivation, it is important to reiterate that proposed discharges must also comply with the other requirements of the Guidelines (i.e., 40 CFR 230.10(b),(c) and (d)). In addition, evaluations of all discharges, whether or not the proposed discharge is associated with a water dependent activity, must comply with the provisions of the National Environmental Policy Act, including an investigation of alternatives to the proposed discharge. Further, applications for discharges associated with cranberry cultivation will continue to be evaluated in accordance with current applicable Corps and EPA policy and practice concerning mitigation, cumulative impact analysis, and public interest review factors.

8. This guidance expires 31 December 1995 unless sooner revised or rescinded.

FOR THE DIRECTOR OF CIVIL WORKS:

ROBERT H. WAYLAND, III
Director
Office of Wetlands, Oceans, and Watersheds
U.S. Environmental Protection Agency

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